Space Weather Technical Forecast

Issued on Thursday, 17 February 2022 at 01:24 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Active electron fluence.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Very Low to Low over the past 24 hours, with only minor flares and just one C1 flare at 16/2335 UTC. This came from AR2941, which transited to the far side through the 16th, but was classified as Eki / Beta-Gamma before it did. This leaves 6 sunspot regions on the visible disc. AR2948 in the southeast is the most noteworthy of these. It has grown slightly in longitudinal length today, but the majority of its intermediary spots have decayed. It is currently classified as Dso/Beta. All other regions are currently small and simple alpha or beta regions.

No Earth-directed CMEs were in evidence in available coronagraph imagery in the past 24 hours.

Solar Wind / Geomagnetic Activity: The solar wind speed, as measured by DSCOVR at L1, has been at background levels, between 350 and 400 km/s. The density was below average (<5 ppcc) until 16/1300 UTC when it rose to average and remained between 5 and 8 ppcc for the rest of the period. The IMF has been weak throughout, but increased slightly from 16/1230 UTC, with a peak of 7 nT, while the north-south component ranged from +2 to -6nT. The phi angle was predominantly negative (towards the sun).The net result of the above solar wind measures was mostly Quiet (Kp 1-2), but an Unsettled (Kp 3) interval was observed 16/1800-2100 UTC during a sustained period of weakly negative BZ.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) measured at GOES 16 was at background levels, but increased slightly around 16/0800 UTC, with a peak of 1.3 pfu at 16/1420 UTC. This was probably due to the large CME which occurred on the far side late on the 15th.

The high energy electron flux (greater than 2MeV) was at High (>1000 pfu) levels through much of the period, with a peak of 9000 pfu at 16/1630 UTC. It has subsequently declined and dropped below the High level at 16/2200 UTC. The corresponding 24-hour integrated electron fluence has remained steady above the 1e8 Active level throughout, with a reading of 2.81e8 integrated pfu at 17/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is likely to remain Very Low or Low through the forecast period, with a chance of C-class flares and slight chance of M-class, most likely on day 1 (17th) whilst 2941 remains near the west limb on the far side.

Solar Wind / Geomagnetic Activity: No CMEs feature in this forecast period. Solar winds are likely to remain at ambient levels through the forecast period, leading to predominantly Quiet geomagnetic activity. However, there is a chance of winds becoming elevated later on day 3 (19th) into day 4 (20th) due to CH55/-. If this was to happen geomagnetic activity would likely become Unsettled to active, and there would be a chance of a G1 / Minor geomagnetic storm.

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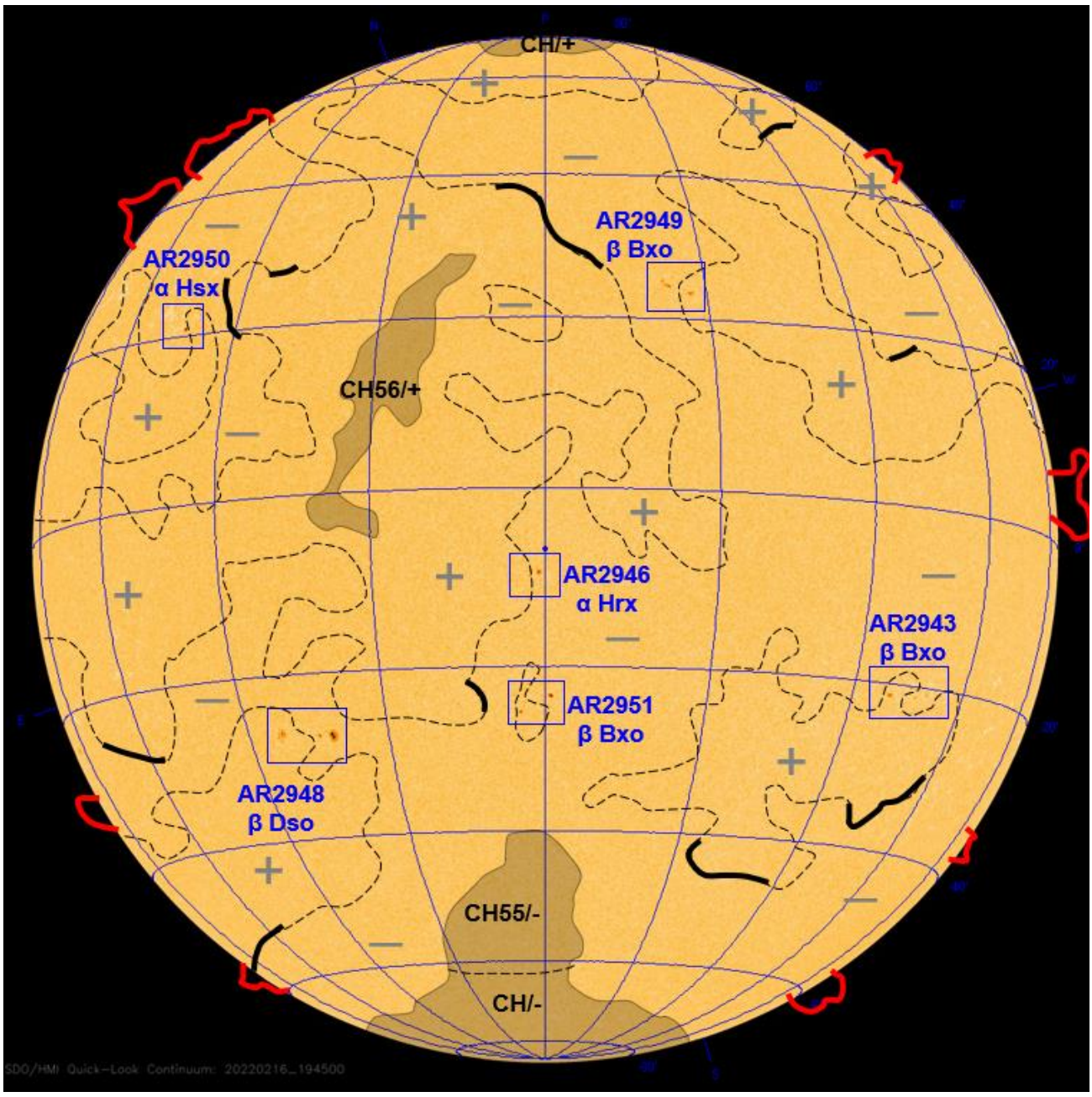
Energetic Particles / Solar Radiation: The high energy proton flux is expected to remain at background levels during the period. The High (>1000 pfu) electron flux and corresponding Active (>1e8 integrated pfu) electron fluence is likely to gradually decrease to background levels over the next couple of days under the influence of a slow wind regime.

Figure 1. Solar Analysis Valid 16/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

No CMEs feature in this forecast at present, however confidence in this is somewhat lower than usual given numerous (particularly westward-directed) CMEs observed around the very end of the last week.
Solar winds are currently at ambient levels. It is likely that they will remain at this level throughout much of the forecast period, leading to predominantly Quiet geomagnetic activity and just isolated Unsettled spells during any sustained periods of negative BZ. However, later on day 3 (19th) into day 4 (20th) there is a chance that Earth will connect to the high speed stream from negative coronal hole 55 (CH55/-), which is an extension of the southern crown. If this was to happen elevated solar winds would likely result in Unsettled to Active geomagnetic activity, with a chance of a G1 / Minor geomagnetic storm.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	10	20
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil

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Radio Blackouts - X-Ray Flares:

There are currently 6 active sunspot regions on the Earth facing disc, after 2941 transited to the far side during the 16th. 2941 was previously the largest and most active region on the disc, with the majority of the remaining regions on disc small and simple alpha or beta regions. However, AR2948 in the southeast is slightly more developed and is classified Dso/Beta. There is also the potential that EX2936 may rotate round the eastern limb later in the period, although no obviously bright region is visible on STEREO-EUVI at the time of writing.
Solar activity has reduced to Very Low levels over the past 24 hours, but there remains a chance of C-class flares, and a slight chance of an M-class throughout the forecast period. This is most likely on day 1 (17th) whilst 2941 remains near the western limb on the far side. Otherwise, 2948 is the most probable candidate for any significant flares.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	20	10	10	10
Very Active	R3 to R5 X Class	No	2	1	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux, as measured by GOES-16 is at background levels. Solar radiation storms are not expected in the period, however there is a very slight chance early on day 1 (17th) whilst 2941 remains near the western limb on the far side.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	2	1	1	1
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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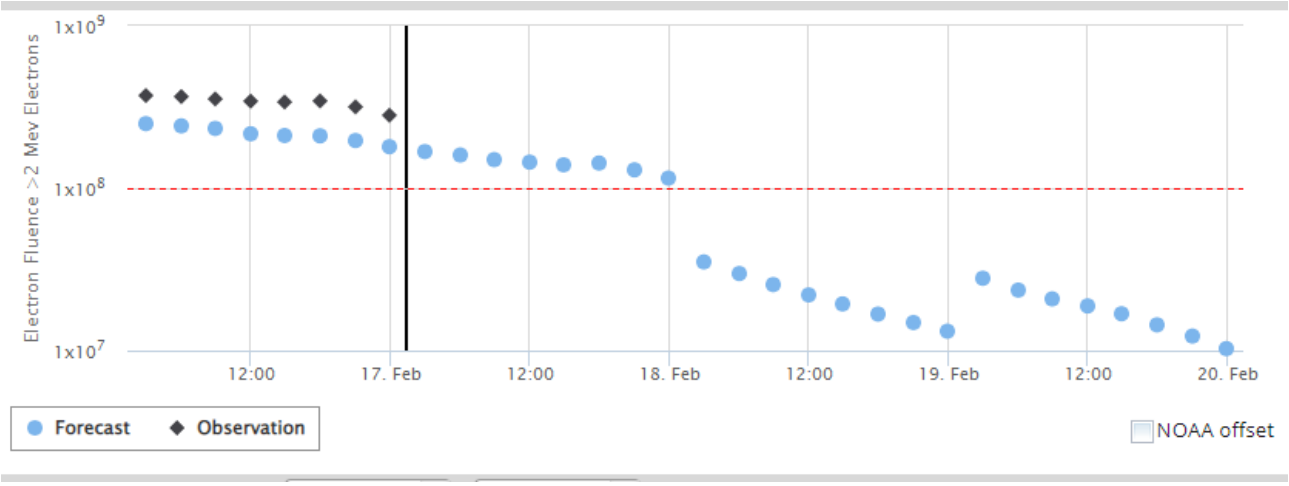
High Energy Electrons Event (≥ 2MeV):

Electron flux is currently reaching High levels (>1000pfu) and the corresponding fluence is above the Active (1e8 integrated pfu) threshold. Over the next couple of days these should steadily decrease to background levels, under the influence of a slow wind regime, with REFM offering good guidance. The possibility of increased geomagnetic activity later in the week would also aid in the reduction.

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	Yes	100	70	40	20
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 2: GOES 16 observed electron fluence and REFM data.



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